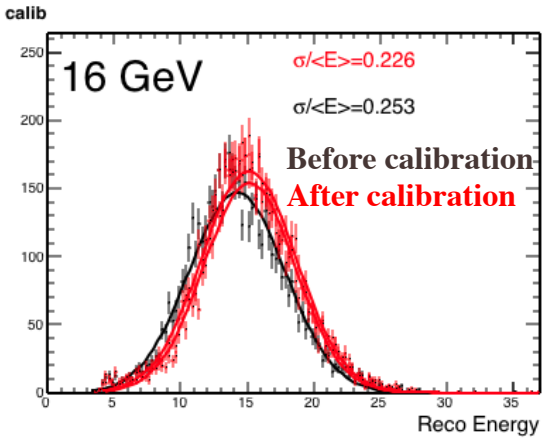
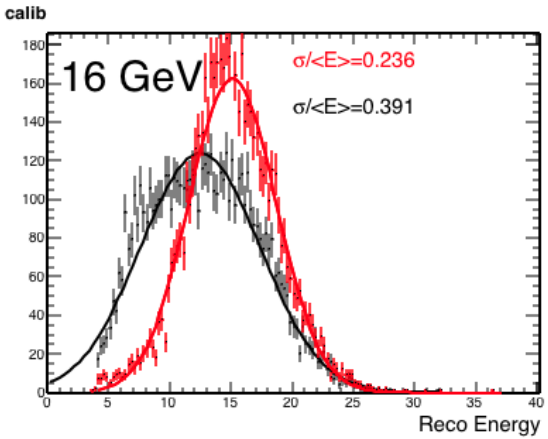
Testbeam analysis update

Abhisek Sen

Calibrations

Reconstructed energy for hadrons (EMCAL + HCALIN + HCALOUT)





Run(s)/sPHENIX Calo	Run(s)/PbGl, 1200V	Run(s)/PbGl, 1100V	Beam	Event	Comment
2722			-16	50K	EMCal normal bias C1 = 1.3 psia, C2 = 1.5 psia
2723, 2724		2725	-16	50K	EMCal lower bias @ gain of 1.15E5. C1 = 1.3 psia, C2 = 1.5 psia

- Needed a run dependent calibration scheme.
- Calibrations can depend
  - Running conditions
  - Energy (Sampling fractions changes)

Methodology

- Created a root minimizer to give best possible reconstructed energy.
- Tower-to-tower calibrations: HCAL: Cosmic, EMCAL: MIPs
- Overall scale:

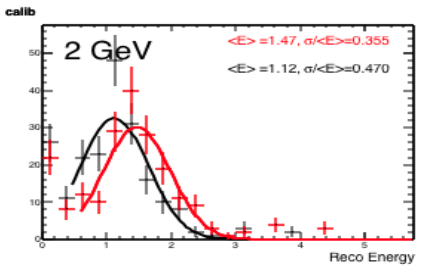
$$E_{reco} = p_1 E_{EMCAL} + p_2 E_{HCALIN} + p_3 E_{HCALOUT}$$
$$p = Min(\Sigma_{i=0}^{N_{events}} (E_{reco} - E_{truth}))$$

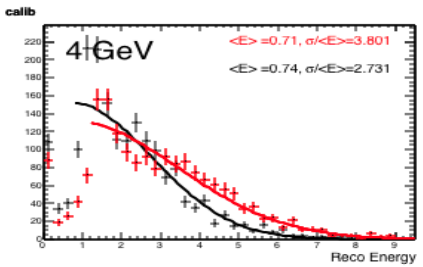
- Used Minuit2:

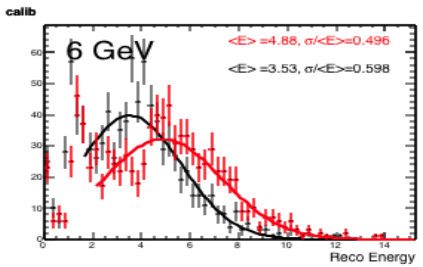
```
ROOT::Math::Minimizer *min =
ROOT::Math::Factory::CreateMinimizer(minName, algoName);
```

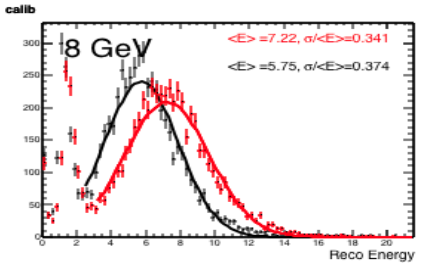
- Two steps:
  - EMCAL_MIP events: $E_{reco} = p_1 E_{HCALIN} + p_2 E_{HCALOUT}$
  - Total: $E_{reco} = p_3 E_{EMCAL} + p_4 (p_1 E_{HCALIN} + p_2 E_{HCALOUT})$

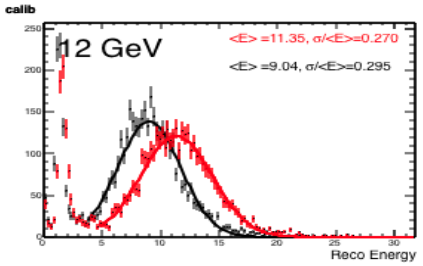
EMCAL MIP events

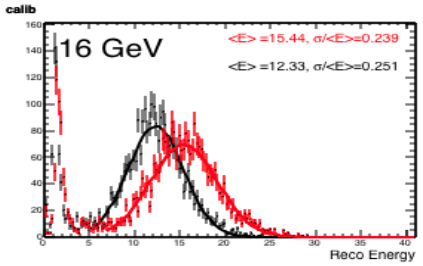


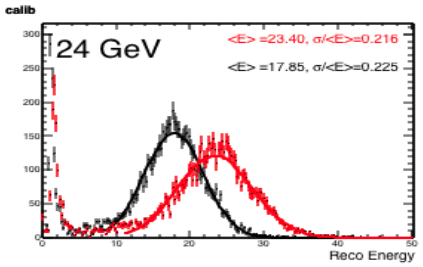


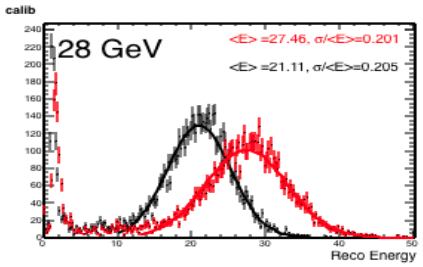












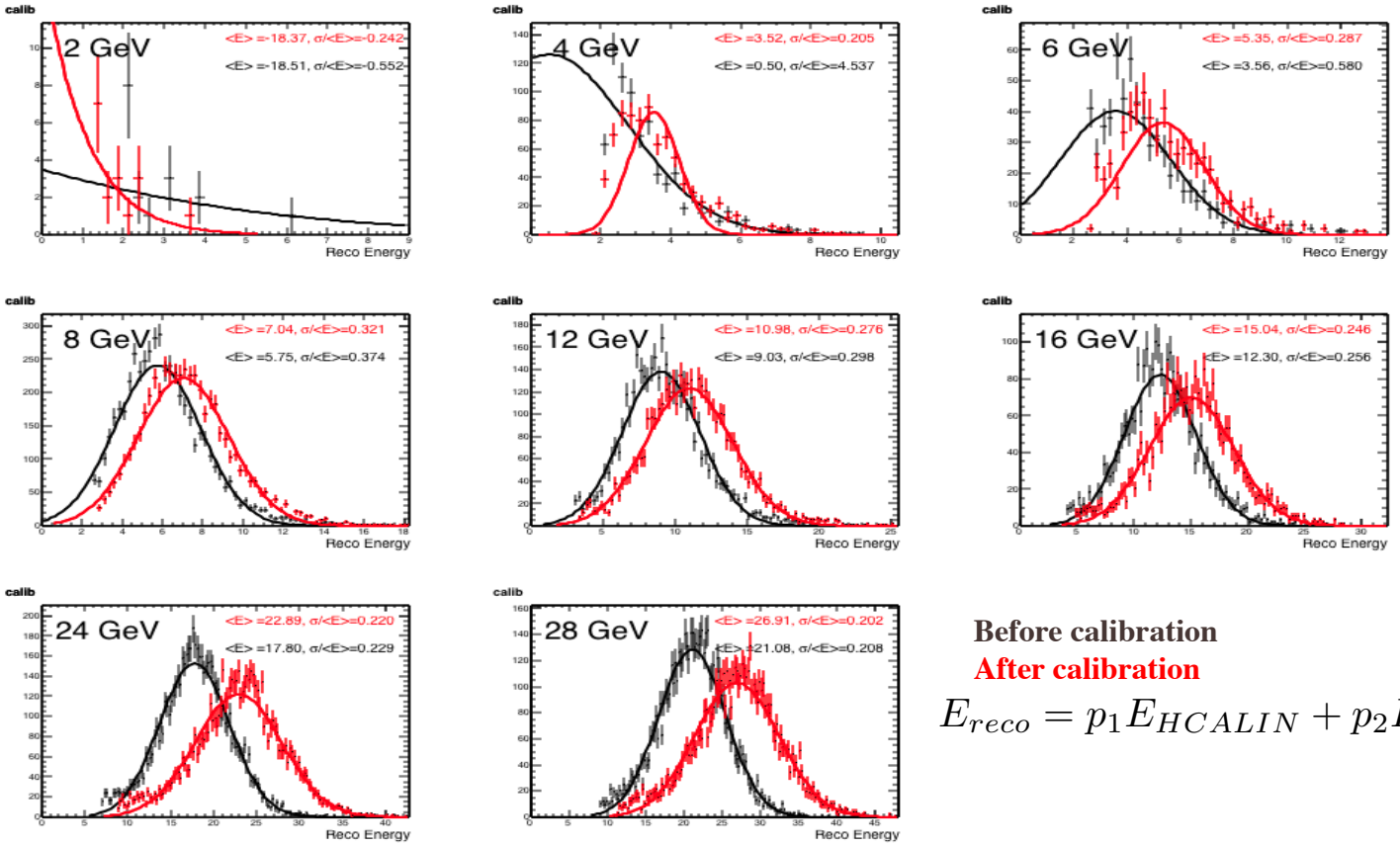
Before calibration

After calibration

$$E_{reco} = p_1 E_{HCALIN} + p_2 E_{HCALOUT}$$

- Some improvement in the overall resolution.
- E_{EMCAL}<0.5GeV
- Cherenkov cut < 10 to select a good hadron sample.

EMCAL MIP events



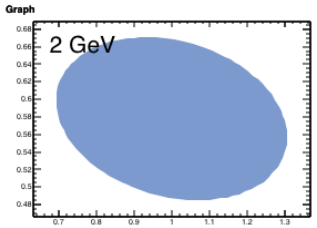
Before calibration

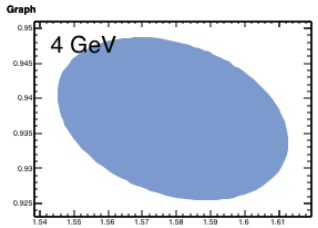
After calibration

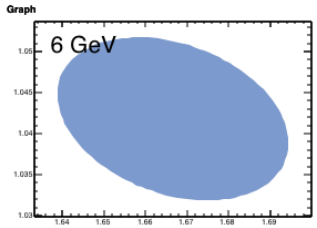
$$E_{reco} = p_1 E_{HCALIN} + p_2 E_{HCALOUT}$$

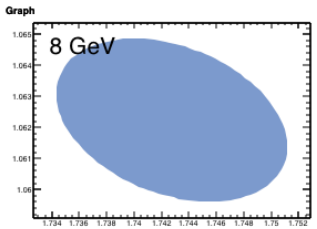
- Same as before but now without the muon MIP peak.
- Overall the algorithm works better without the muon MIP peaks.

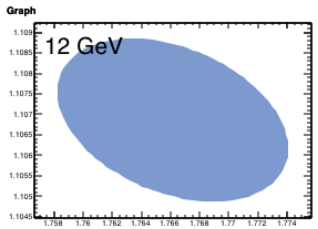
HCAL weight parameters

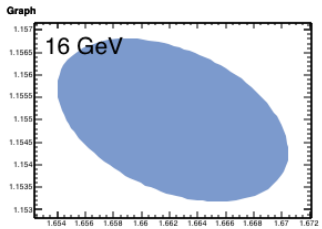


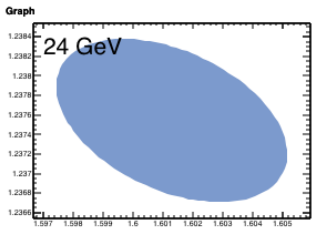


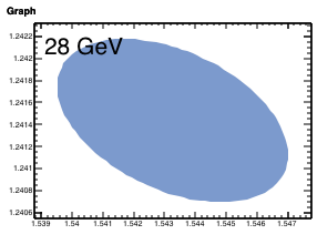




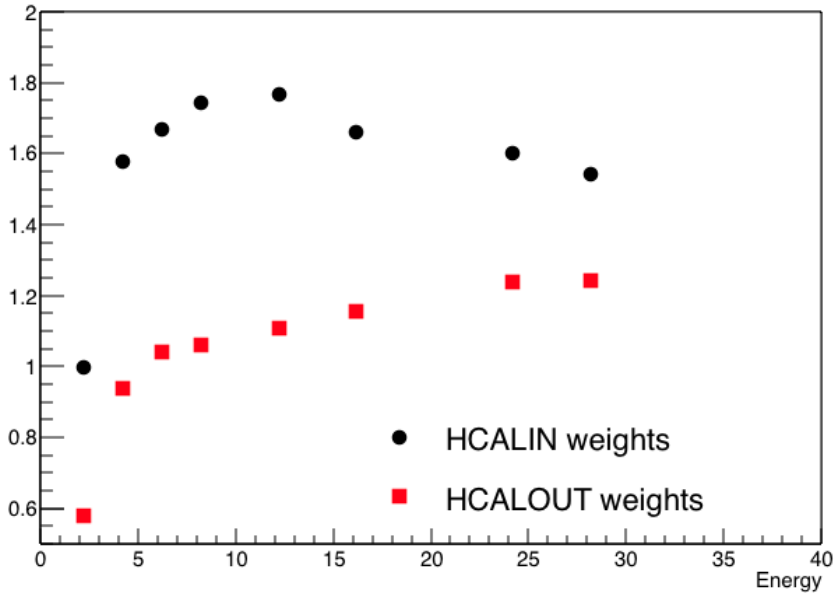




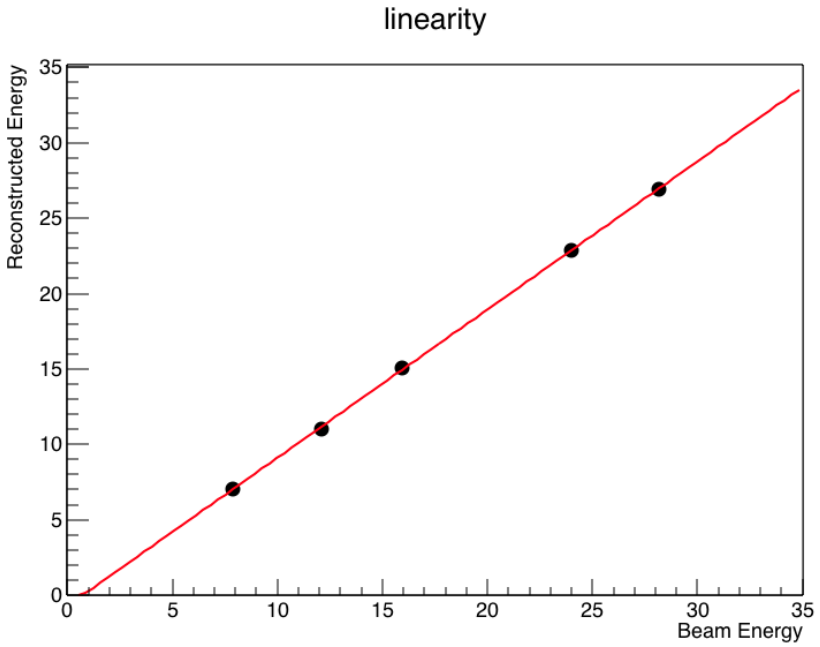


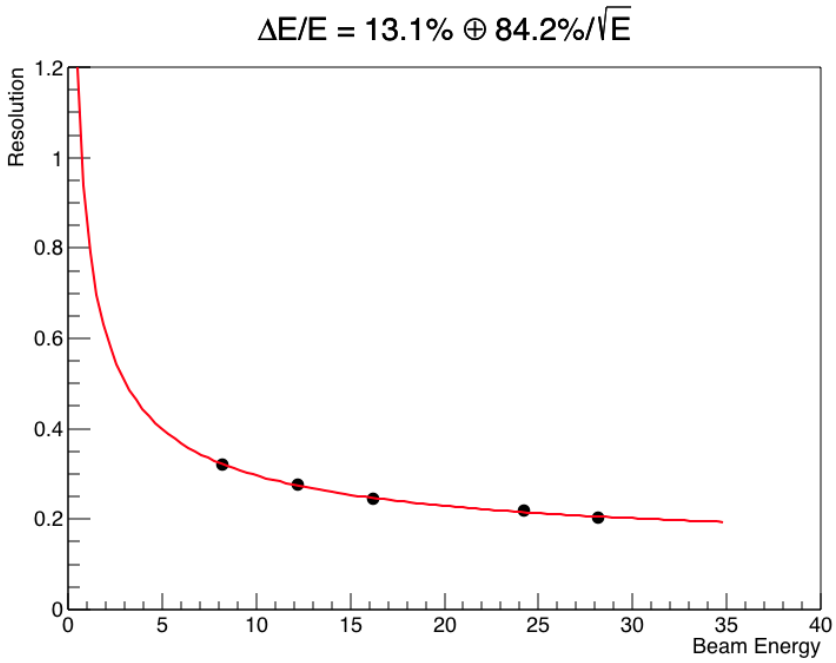


Contour plots of the weights for:
function = Min + Error()

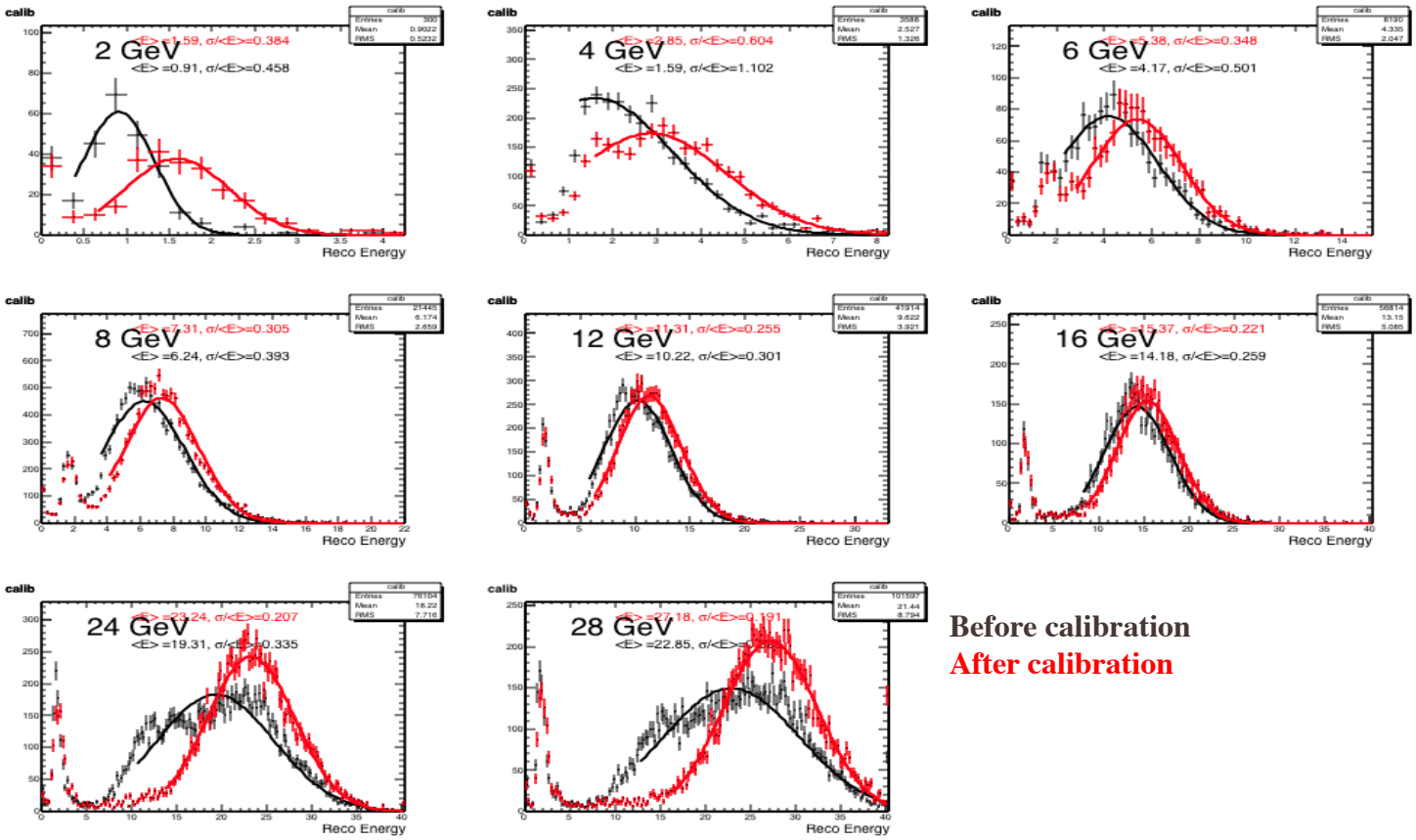


Resolution : EMCAL MIP





All three calorimeters

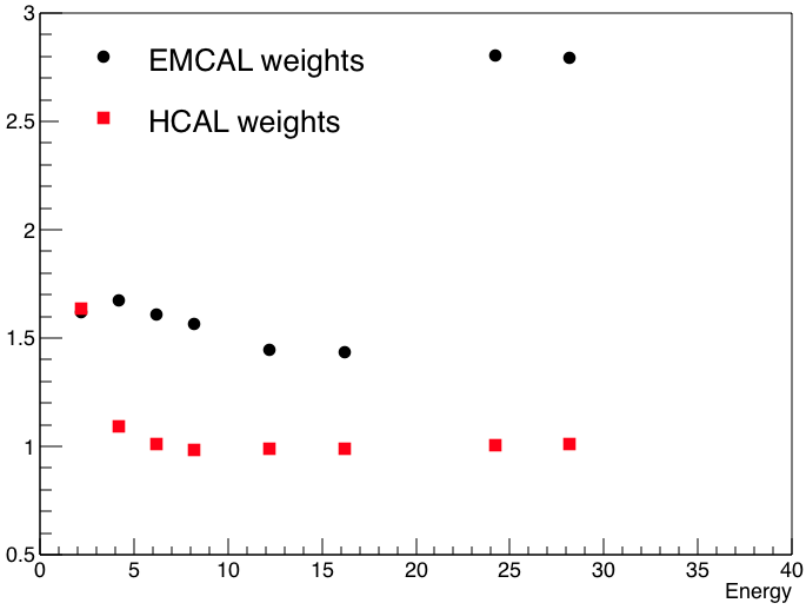


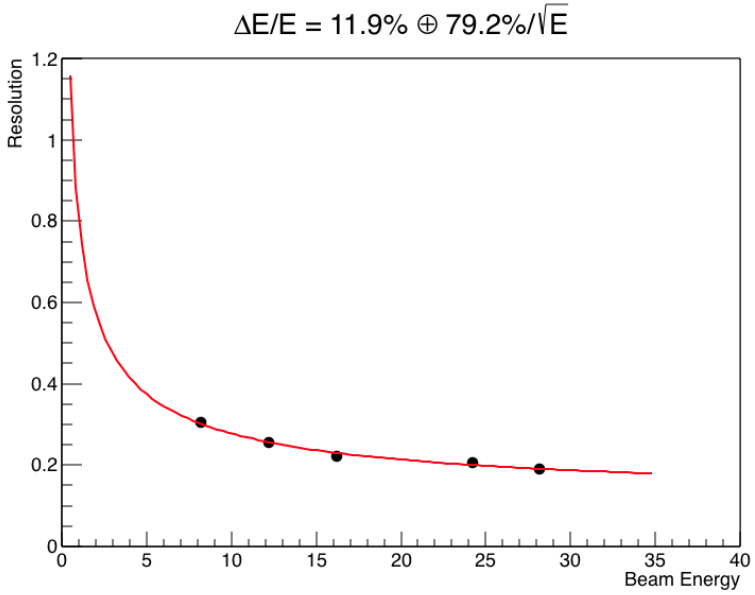
Before calibration

After calibration

$$E_{reco} = p_3 E_{EMCAL} + p_4(p_1 E_{HCALIN} + p_2 E_{HCALOUT})$$

Resolution : ALL

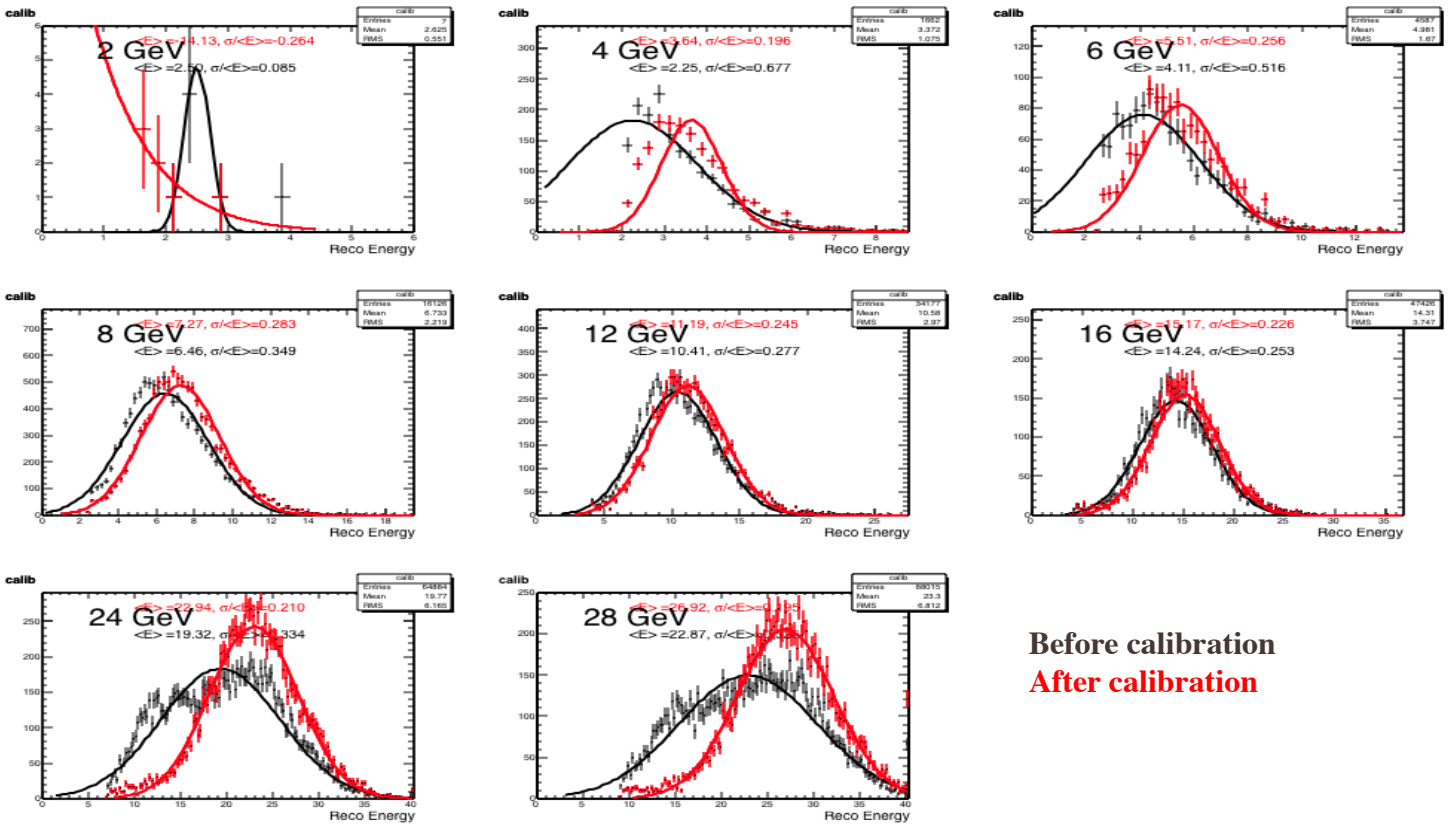




Running conditions changed for last two energy runs.

Run(s)/sPHENIX Calo	Run(s)/PbGl, 1200V	Run(s)/PbGl, 1100V	Beam	Event	Comment
2692	2693		-2	>100K	EMCal normal bias. C1 = 12.0 psia, C2 = 12.5 psia
2695			-4	>200K	EMCal normal bias C1 = 12.0 psia, C2 = 12.5 psia
2696	2697		+4	>200K	EMCal normal bias C1 = 12.0 psia, C2 = 12.5 psia
2698 2700 2701	2702		-6	57205	EMCal normal bias C1 = 12.0 psia, C2 = 12.5 psia
2703,2704,2705,2706,2707,2708,2709,2710			-8	>200K	EMCal normal bias C1 = 5 psia, C2 = 6
2711,2712,2713,2714,2715	2716	2717, 2718	+8	>200K	EMCal normal bias C1 = 5 psia, C2 = 6
2719,2720,2721		2726	-12	>100K	EMCal normal bias C1 = 1.3 psia, C2 = 1.5 psia
2722			-16	50K	EMCal normal bias C1 = 1.3 psia, C2 = 1.5 psia
2723, 2724		2725	-16	50K	EMCal lower bias @ gain of 1.15E5. C1 = 1.3 psia, C2 = 1.5 psia
2727		2728, 2729	-24	>100K	EMCal lower bias @ gain of 1.15E5 C1 = 0.4 psia, C2 = 0.5 psia,
2730		2733, 2735, 2736, 2737	-28	>100K	EMCal lower bias @ gain of 1.15E5 C1 = 0.4 psia, C2 = 0.5 psia,

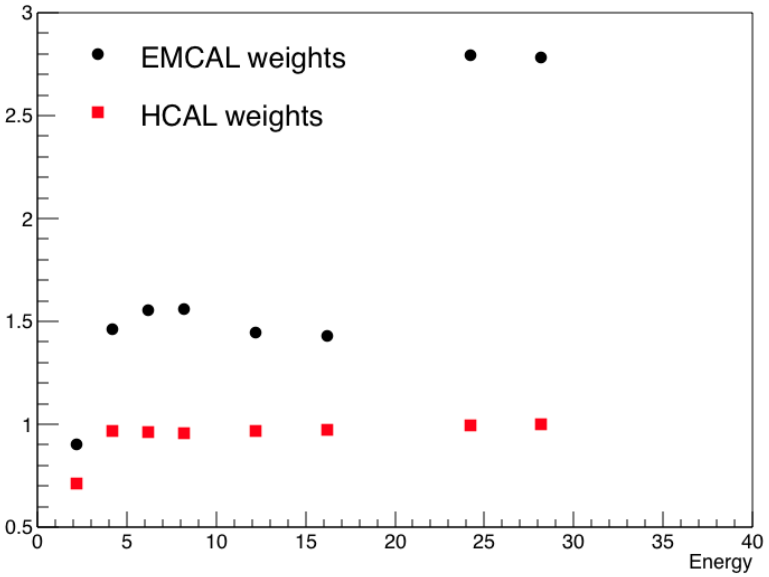
All three calorimeters

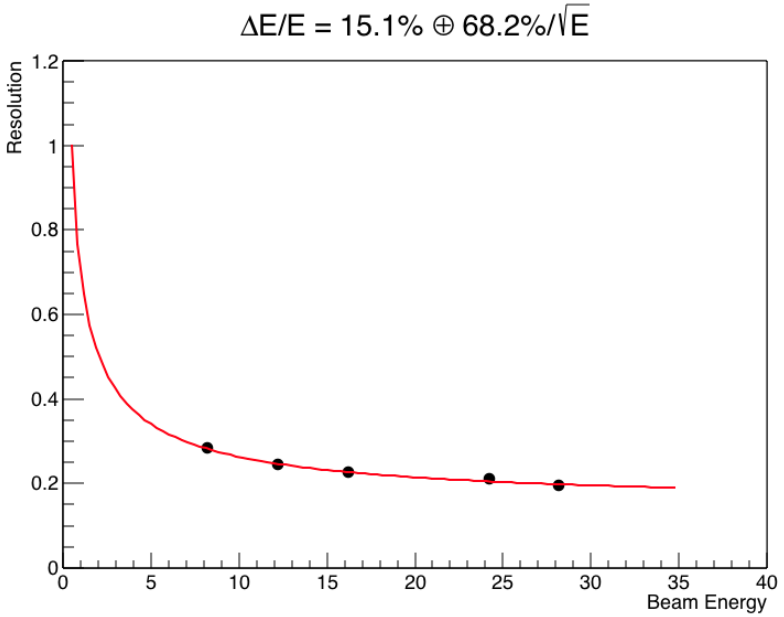


Before calibration
After calibration

Same as before but without the muon peaks.

Resolution : ALL

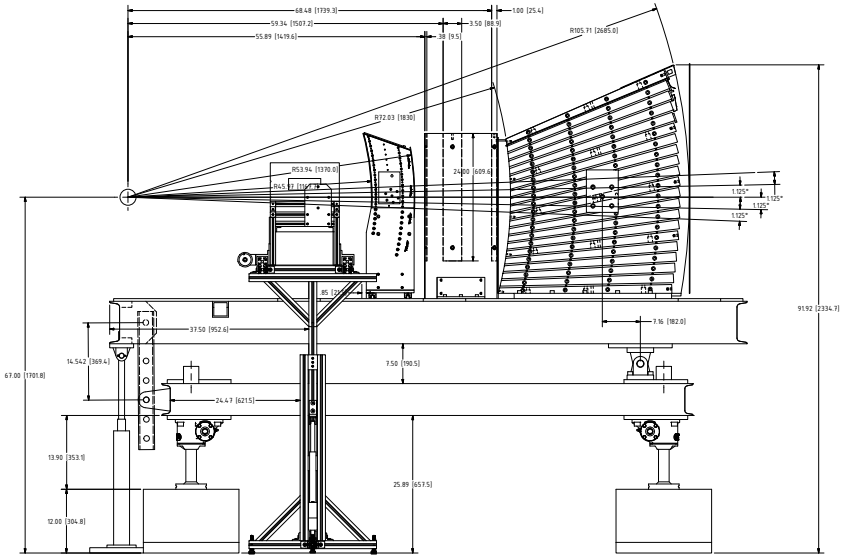




Better resolution when relative calibrations are done without the muon MIP peak

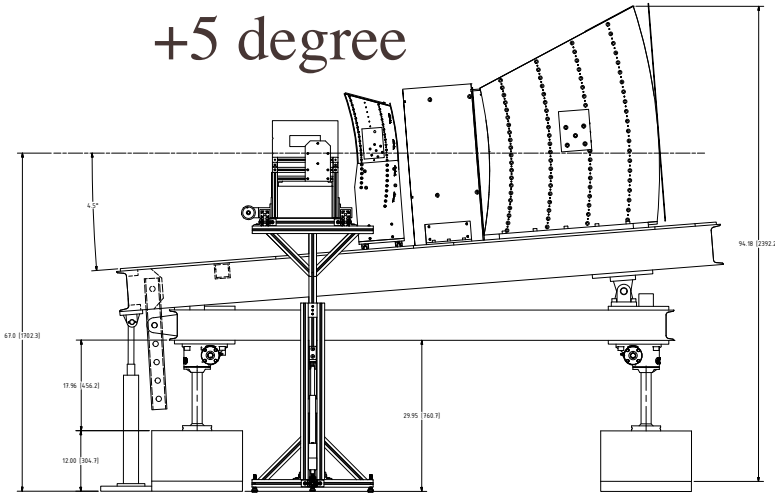
Tilting

Normal position



HORIZONTAL POSITION

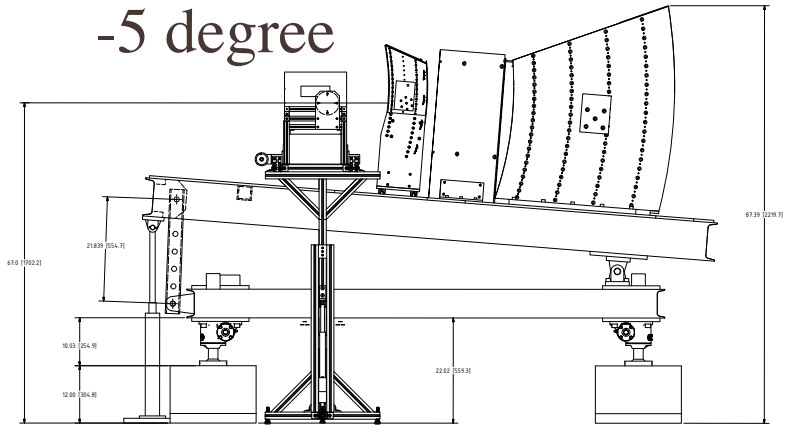
+5 degree



+4.5° POSITION

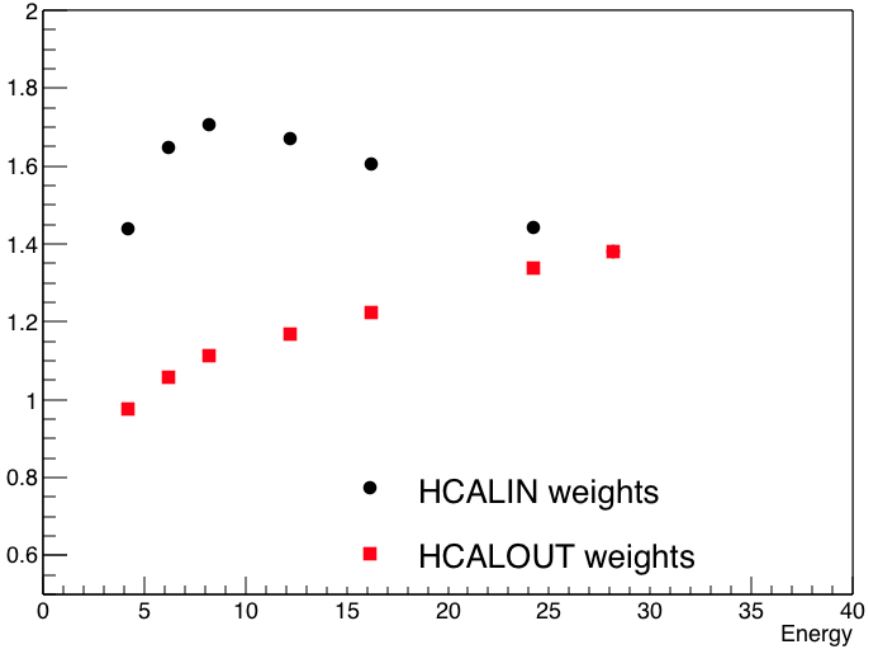
PRELIMINARY

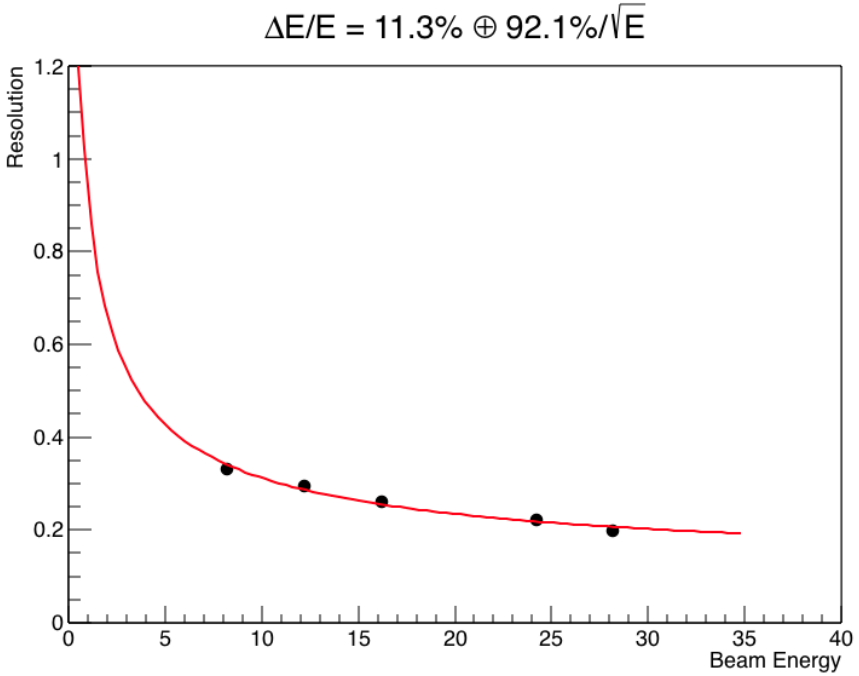
-5 degree

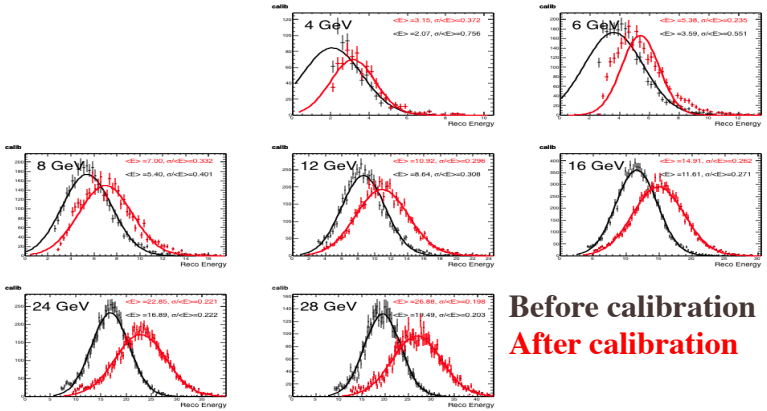


-4.5° POSITION

+5 degree : EMCAL MIP

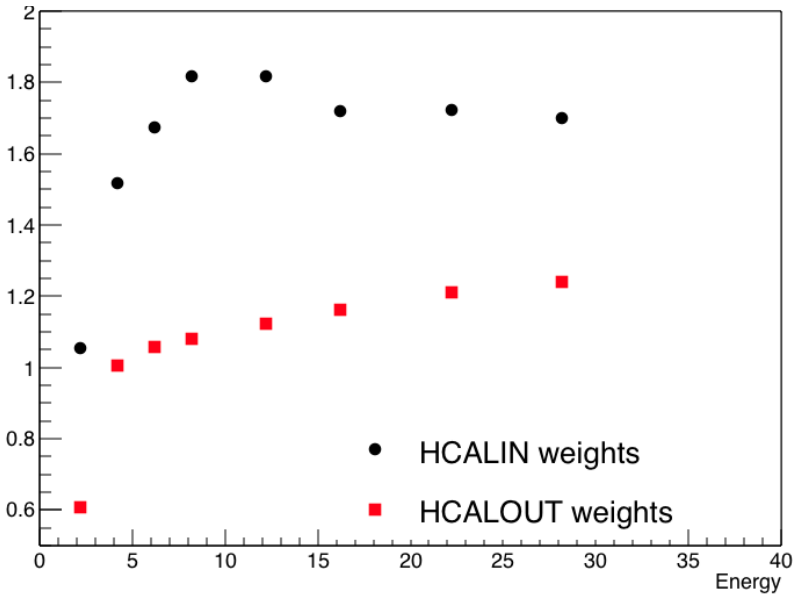


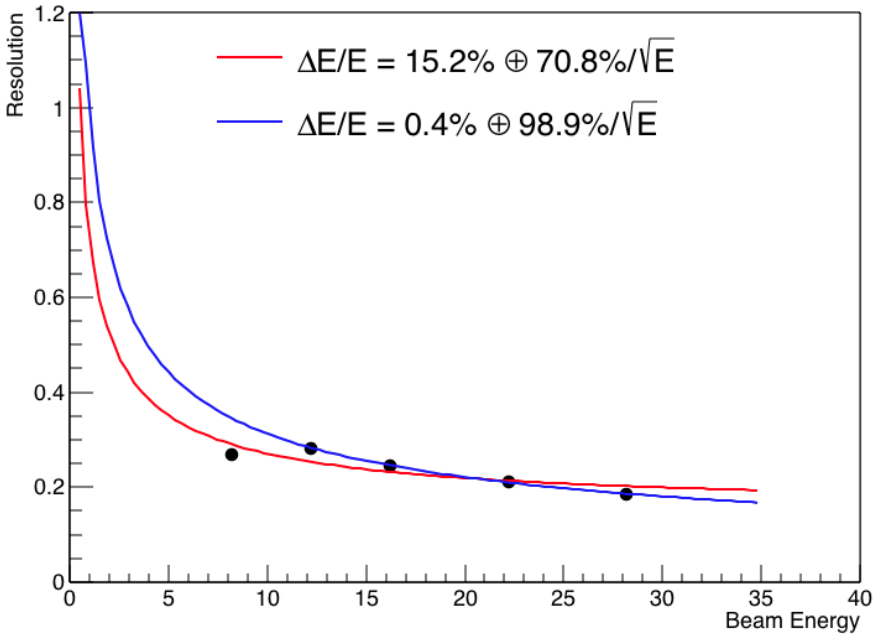


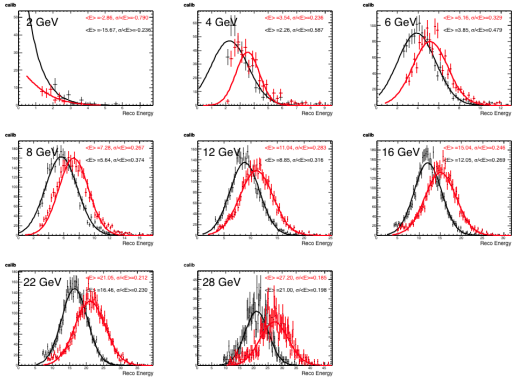


Before calibration
After calibration

-5 degree : EMCAL MIP



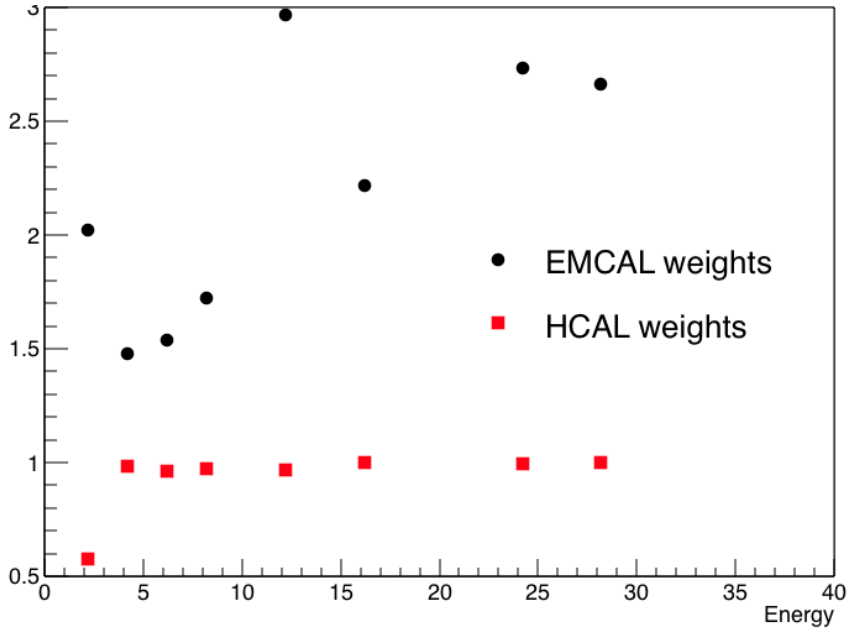


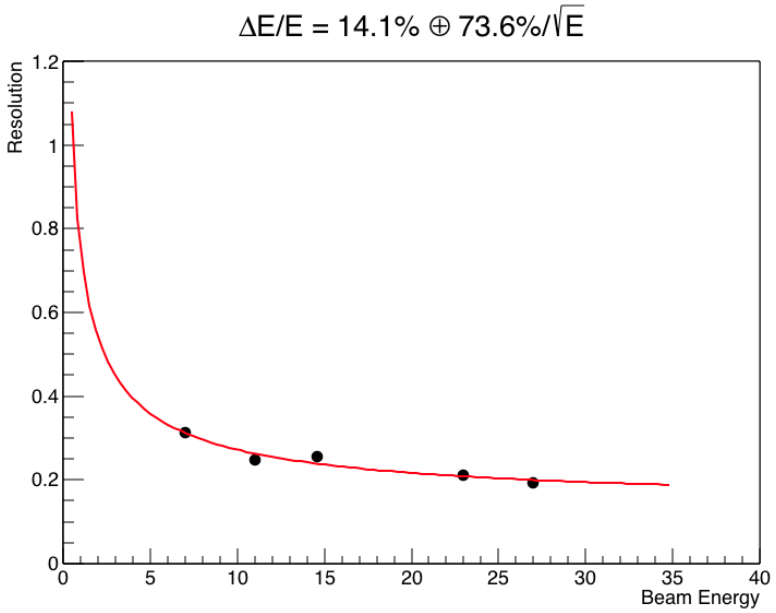


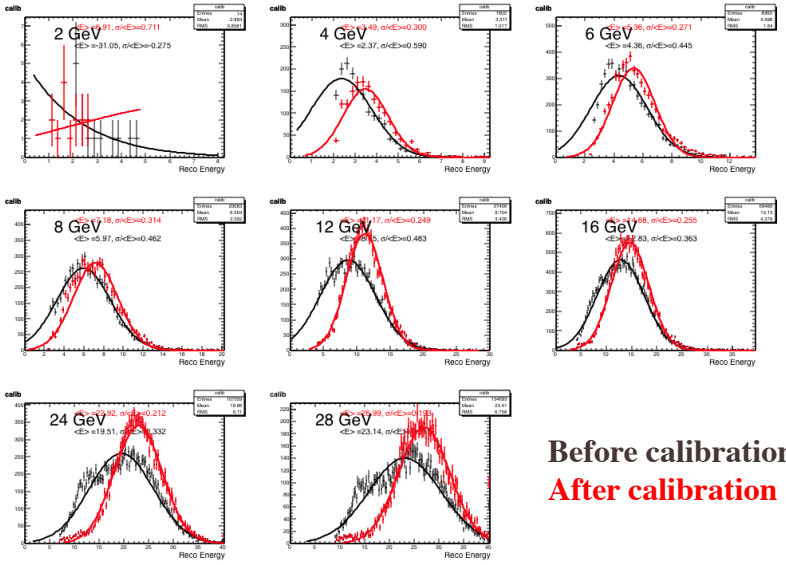
Before calibration

After calibration

+5 degree : ALL Calorimeters

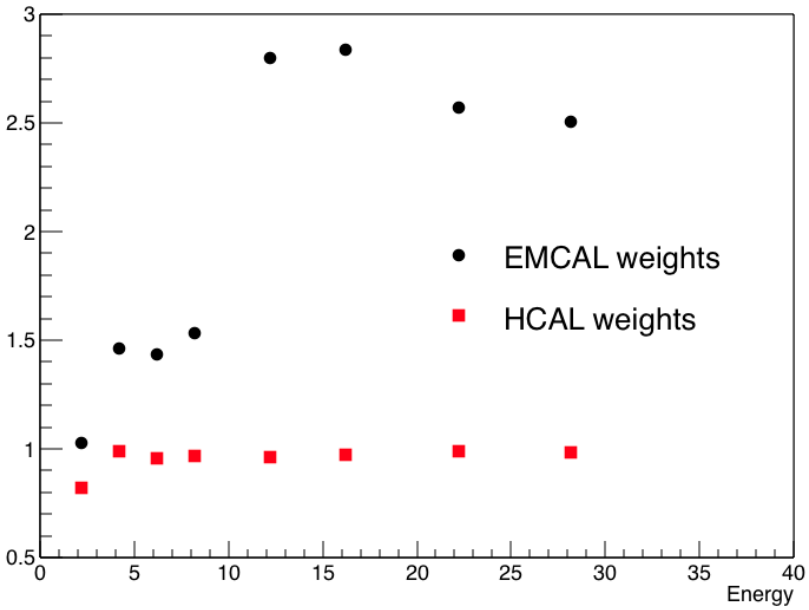


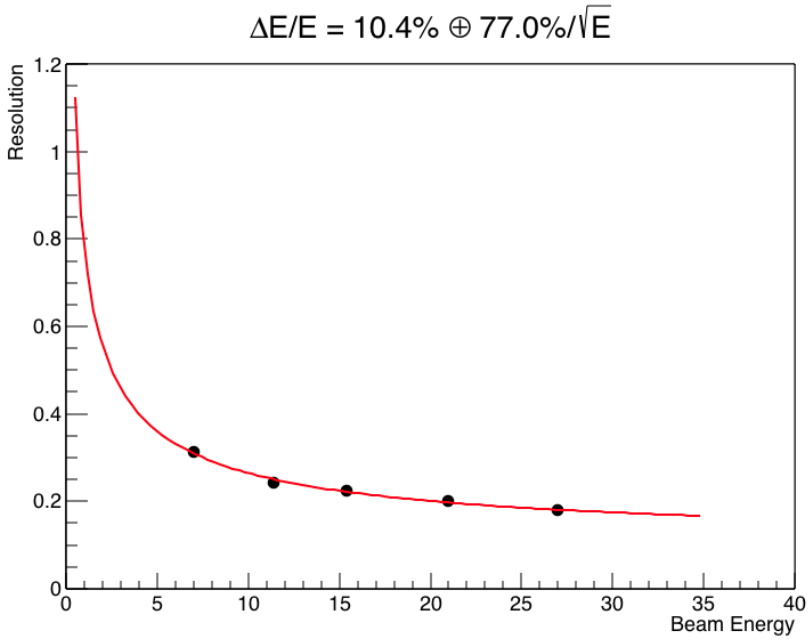


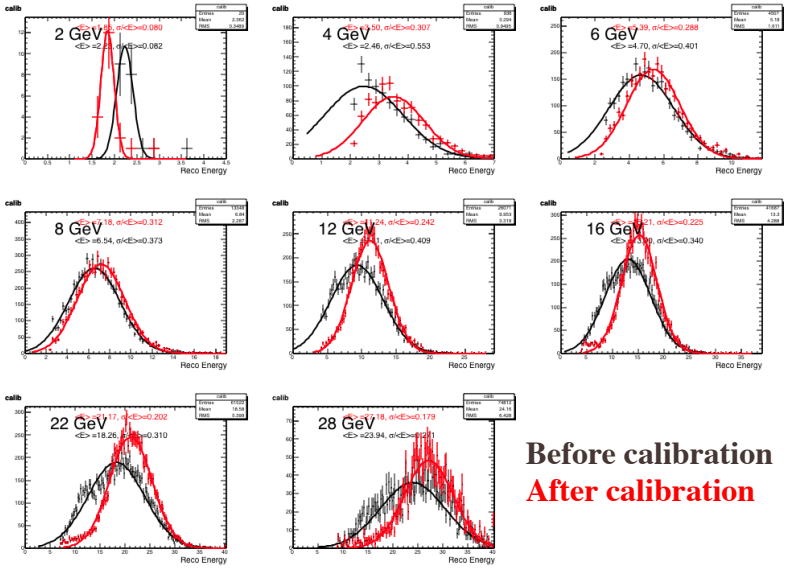


Before calibration
After calibration

-5 degree : ALL Calorimeter







Before calibration
After calibration